WHAT IS CLAIMED IS:

1. A wavelength converter with wideband four-wave-mixing, comprising:

a laser diode for using as an optical carrier to carry an input electrical signal;

an optical modulator, having a first input terminal connected by an optical fiber to the modulated laser diode and a second input terminal receiving the input electrical signal, thus modulating the input electrical signal to a optical beam of the modulated laser diode and accordingly generating an optical signal;

a first polarization controller, connected by an optical fiber to a terminal of the optical modulator, thus controlling polarization of the input optical signal;

a first tunable laser, generating a first pump with a first wavelength, thus determining required conversion range;

a second tunable laser, generating a second pump with a second wavelength, thus determining the required conversion wavelength;

a second polarization controller, connected by an optical fiber to the second tunable laser, thus controlling the polarization of the second pump;

an optical coupler, coupling the input optical signal, the first pump and the second pump into an optical fiber;

a semiconductor optical amplifier (SOA), connected by an optical fiber to the optical coupler, thus generating a converted signal with four-wave mixing (FWM) using its third-order nonlinear property;

a third tunable laser, generating an assist beam with a third wavelength; and

a multiplexer, having a first input terminal connected by an optical fiber to an output of the SOA and a second input terminal connected by an optical fiber to the third tunable laser, thus injecting the assist beam and output the converted signal into an output fiber.

2. The converter as claimed in claim 1, further comprising an optical isolator, coupled between the optical coupler and the SOA, thus limiting transmitting beam in a single direction.

3. The converter as claimed in claim 1, further comprising an optical filter for filtering the converted signal.

4. The converter as claimed in claim 1, wherein the laser diode is a distributed feedback laser diode (DFB-LD).

5. The converter as claimed in claim 1, wherein the optical modulator is a LiNbO3 optical modulator.

6. The converter as claimed in claim 1, wherein the first polarization controller controls the polarization of the input optical signal in parallel to the polarization of the first pump.

7. The converter as claimed in claim 1, wherein the second polarization controller controls the polarization of the second pump orthogonal to the polarization of the first pump.

8. The converter as claimed in claim 1, wherein a wavelength of the laser diode is a wavelength in the SOA's bandwidth.

9. The converter as claimed in claim 1, wherein a wavelength of the

assist beam is a wavelength out of the SOA's bandwidth.

10. The converter as claimed in claim 9, wherein the wavelength is a short wavelength.

11. The converter as claimed in claim 1, wherein the multiplexer is a wideband multiplexer capable of passing through 14xx nm and 15xx nm beams.

12. The converter as claimed in claim 1, wherein a wavelength difference between the laser diode and the first pump is a value smaller than 2 nm.

13. The converter as claimed in claim 1, wherein the second pump's wavelength generated by the second tunable laser is adjusted to a predetermined wavelength.

14. The converter as claimed in claim 1, wherein the optical coupler injects the input optical signal, the first pump and the second pump into the SOA.

15. The converter as claimed in claim 1, wherein the third tunable laser generates an assist beam which is combined with the input optical signal, the first pump and the second pump for injection into the SOA.

16. The converter as claimed in claim 15, wherein the assist beam is a short-wavelength beam.

17. The converter as claimed in claim 1, wherein the converted signal generated by the SOA is filtered by a tunable optical filter.

18. The converter as claimed in claim 15, wherein the assist beam is injected into the SOA inversely.